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Introduced Small Ground Predators in California Brown Pelican Colonies

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Abstract.—In contrast to small- and medium-sized seabirds, California Brown Pelicans are little affected in their nesting colonies by introduced small predators such as domestic cats and rats. Conflicts between small introduced mammals and smaller to medium-sized seabirds dictate nonetheless that control and eradication of such predators are highly desirable goals. In one unusual instance where cats regularly preyed on nestling Brown Pelicans, this occurred only on the colony periphery. The few large pelican young taken by these cats represented, however, the largest prey item known to be taken by feral cats. Received 22 July 1988, accepted 30 December 1988.

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Many small human commensals (e.g. rats, *Rattus* spp.; and cats, *Felis catus*) have been introduced onto islands where seabirds nest. Although the devastating negative impacts of such small mammalian predators on small and medium-sized seabirds are well-known, extensively documented, and generally predictable (Moors and Atkinson 1984, Lever 1985), it is also important to determine the degree to which such organisms prey upon or disturb large seabirds such as the California Brown Pelican (*Pelecanus occidentalis californicus*). Here, we report interactions and related observations between Brown Pelicans, cats, and rats in breeding colonies off Baja California and Southern California (Fig. 1). "Predation" or evidence of it is defined as the attacking and/or consumption of brown pelican eggs, young, or adults while they are still alive. Moors and Atkinson (1984: 667) have termed this "alien predation" when caused by introduced fauna.

In the early-1970s, some resource managers alleged that a severe population decline of Brown Pelicans off Southern California had been caused by predation from introduced cats and/or rats. This claim was perhaps stimulated by Presnall's earlier report (1958); but see Anderson and Gress (1981) and U. S. Fish and Wildlife Service (1983) for an analysis of this decline caused by pollutants. We recorded incidental observations of vertebrate in-

teractions during our activities on the nesting islands starting in 1970, and here report the few instances that we observed.

Indications from Other Studies

In their classic review, Moors and Atkinson (1984: 671), referring to introduced feral cats, stated: "Probably no other alien predator has had such a universally damaging effect on seabirds." Hubbs (1951) stated that cats have an "unsavory reputation" especially regarding their devastating effects on smaller birds. Murphy (1936: 625) provided numerous accounts of devastation to nesting seabirds by introduced rats (called in one instance "ubiquitous and murderous"), feral cats, and larger mammals such as dogs and pigs. The smaller bird species have invariably been the most vulnerable and most negatively affected by cats and rats (see Pye and Bonner 1980), but Stonehouse and Stonehouse (1963) reported direct cat predation also on comparatively large (for a cat) adult Ascension Island Frigatebirds (*Fregata aquila*). Murphy (1936: 827) also cited an instance where cats "wrought much havoc" in a Peruvian Brown Pelican (*P. o. thagus*) colony and Presnall (1958) mentioned a "serious conflict" between cats and Brown Pelicans at Anacapa Island. This specific reference to one of our study sites was the only instance cited by

Presnall (1958) where cat and large-sized seabird interactions were believed to be ecologically important; yet there is no further mention of this potential problem in subsequent literature, nor were there any details given.

Other studies provide contrast. Kirkpatrick and Rauzon (1986) believed that adult Masked Boobies (*Sula dactylatra*) effectively defended their nests against cats. Apps (1986) stated that cats on Dassen Island, South Africa did not alter their hunting behavior to take strongly defensive birds like large seabirds, even though such birds represented the most abundant potential prey. The cats preferred mammalian prey.

A most unusual case of predation upon nesting, adult Laysan Albatrosses (*Diomedea immutabilis*) by Polynesian Rats (*R. exulans*) (Kepler 1967) has not been reported to occur with other *Rattus* species. However, Grant et al. (1981) reported rat predation on eggs as large as those of the Black-footed Albatross (*D. nigripes*) (and about the same size as the eggs of a Brown Pelican) in a situation of high rat density.

Study Areas

Our principle study areas (Fig. 1), because of the known presence of introduced potential small predators, were (1) Western Anacapa Island, California, (2) Isla Santa Margarita, Baja California Sur (extensively occupied by humans within 11 km of nesting pelicans), and (3) Isla San Pedro Martir in the Gulf of California, occupied by Norway Rats (*R. norvegicus*) (Villa-R. 1979) and Black Rats (*R. rattus*) (B. Wilcox pers. comm.) (one of approximately 12 major pelican colonies in the Gulf, Fig. 1). The two former locations are Brown Pelican colonies along the Pacific Coast (among about 6 major pelican colonies) where cats and Black Rats occur or have occurred in the past. Most of the additional islands in our Brown Pelican studies (U. S. Fish and Wildlife Service 1983) were free of introduced rats or cats, but contained small-sized native rodents and reptiles (Anderson et al. 1976, DeWeese and Anderson 1976). Some islands in the Gulf of California used by other species of seabirds, however, did have rats and some also had cats (see references just cited and references therein). Rats and/or cats were seen or trapped at all the locations mentioned.

RESULTS AND DISCUSSION

Cat Predation

Isla Santa Margarita, Baja California Sur.—On 22 July 1975, D.W.A. and J.O.K. observed cat predation of young Brown Pelicans up to 5 weeks old on Isla Santa

Margarita, where such attacks may have been facilitated by topography and a large population of cats. A small pelican sub-colony of about 35 active nests on the periphery of a larger colony of about 5,100 nests was bordered by a deep, heavily vegetated canyon that led down some 700 m to a fishing camp where many (10-15 seen) adult and young cats were present. The nearby canyon edge contained two freshly-killed and partially-eaten young pelican carcasses along with eight dried out but similarly stripped carcasses, along with some crushed pelican bones. The fishermen in the camp below confirmed that they had seen their cats stalk, kill, and consume young pelicans. Prof. J. Guzman (Universidad Autonoma de Baja California Sur, pers. comm.) and his students have also since reported to us their personal observations of cats attacking and killing young pelicans at this location. Cat predation was also observed directed at young Magnificent Frigatebirds (*F. magnificus*) at another location on the same island by L.A.M. Individual young that had fallen from their nests and were no longer receiving protection from adults were regularly attacked by single cats (such attacks were seen in their entirety three times in one season) that killed by tearing at the soft underparts of each bird until it succumbed. There were about 10-12 cats associated with this particular frigatebird colony of about 5,000 nests. Cats were also observed by L.A.M. on Isla Santa Margarita at a third location displacing adult Western Gulls (*Larus occidentalis*) from nests and consuming both eggs and young. Cats are apparently serious avian predators on this island despite their negligible effect on Brown Pelicans. This is the only location where instances of cat attacks on Brown Pelicans were successful.

All of this cat predation observed by us in the Brown Pelican colony area occurred on the colony periphery, as would be predicted from colony-edge, increased-vulnerability and "predator swamping" expectations (see Tenaza 1971, Burger 1979, Gochfeld 1980 and 1982, Siegel-Causey and Hunt 1981, Wittenberger and Hunt 1985, and others). In this case, the potentially detrimental effects of the local population of cats was likely "swamped" by the large numbers of pelicans and perhaps

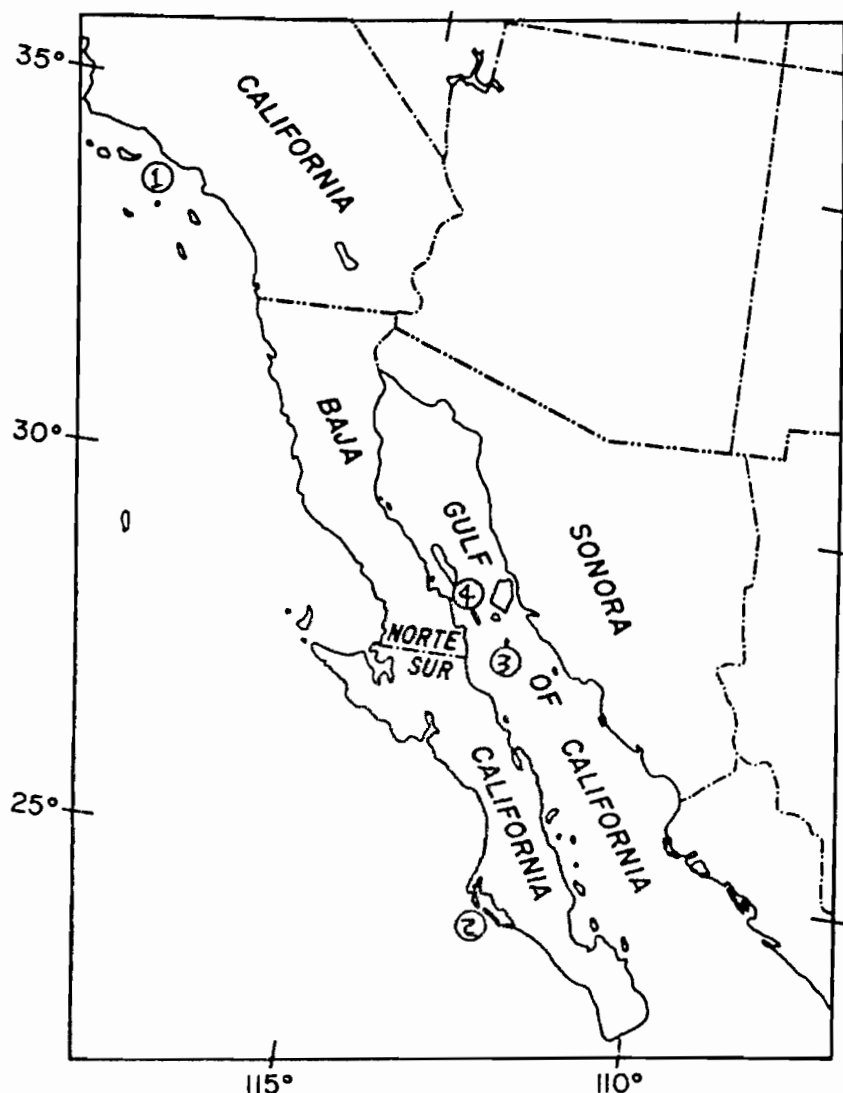


Figure 1. Locations of Brown Pelican colonies where interactions with small introduced manimals were observed. Locations are numbered as follows: 1 = West Anacapa Island, one of California's Channel Islands, 2 = Isla Santa Margarita, 3 = Isla San Pedro Martir, and 4 = Isla San Lorenzo Norte (the largest California brown pelican colony in the range of the subspecies *californicus*, without rats or cats).

also mutual nest defenses farther into the central parts of the colony. Only vulnerable young pelicans were taken, as reported for other large seabirds by Berruti (1981).

West Anacapa Island, California.—Cats were probably first introduced onto West Anacapa Island (Fig. 1) by a local fisherman who lived on the island in the 1930s (Banks 1966). A single cat was still present and seen occasionally by D.W.A. and F.G. on that island during part of our studies there (1969-1975), but we never observed any indications of cat predation (damaged

carcasses or injured young) on Brown Pelicans.

We collected cat feces whenever we encountered them in and around pelican nesting areas. Nine widely-separated samples were obtained and judged to have been deposited during the pelican nesting seasons of 1971-1975 (items were identified by G.R.T.). We cannot draw conclusions about masses of prey consumed (see Zielinski 1986), so only give data here on a qualitative basis. Rodent remains (in order of importance: unidentified hair,

lar small mammals) do not represent a significant predation threat to California Brown Pelicans. Cats and rats on West Anacapa Island were probably never predators of significant impact, because recovery of Brown Pelican productivity and breeding populations (Anderson and Gress 1983) began during a period when both feral cats and rats were present.

Feral cats could depress Brown Pelican productivity in local areas such as at the peripheries of nesting colonies, but this was not observed by us to be extensive in any colony. The one well-documented case of successful cat predation on pelicans involved a large population of cats likely also dependent on nearby human activities and other prey. Where just cats were present, their populations apparently dwindled and disappeared (see also Apps 1986).

Although Norway and Black Rats could have entered pelican colonies at night and not been observed by us, lack of extensive evidence of predation in pelican colonies suggests that it is uncommon or unsuccessful. Under a temporary situation of high rat density and resultant food competition, more significant (albeit short-term) egg predation cannot be ruled out. We would also expect serious negative effects to pelicans from larger predators (canids, procyonids, mustelids, large felids, and man) (Emlen *et al.* 1966, Anderson and Keith 1980, Southern *et al.* 1982).

The presence of introduced cats, rats, and other small mammals on seabird nesting islands must still be considered highly undesirable. First, most of our observations involved low densities of predators. And in one case, cats were apparently causing more serious damage to other species of birds. Although Pye and Bonner (1980) and Moors and Atkinson (1986) reported that rats might be present in some cases with negligible damage to some species of seabirds, control of introduced ground predators is desirable if the control program is not detrimental to native rodents, reptiles, or insects (Cruz and Cruz 1987). The major reason for control would be to reduce predation on smaller seabirds, terrestrial ground-nesters, and other native species and to help restore natural island ecosystems (e. g., Hirons *et al.* 1976, Williams 1978, van Aarde 1980, Grant *et al.* 1981, Jehl and Parkes 1982, Moller 1983, Moors and Atkinson 1986).

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